PERIODICAL FAO Fisheries Biology Synopsis
#5
1/17 Library #5

FAO Fisheries Biology Synopsis No. 5 FB/60/S5
Distribution restricted OT - General

LIBRARY
JAN 17 1962
FISH & WILDLIFE SERVICE

PREPARATION OF REGIONAL FISHERIES OCEANOGRAPHIC SYNOPSES

Prepared by

Fisheries Biology Branch, FAO

FISHERIES DIVISION, BIOLOGY BRANCH
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, December 1960

PURPOSE OF THIS SERIES

The Oceanographic Synopses are documents, within the series of FAO Fisheries Biology Synopses, which summarise available data pertaining to the oceanographic features of the environment of fish stocks and to their relations with that environment, as well as to oceanographic and climatological factors which affect, and may limit, fishing operations. It is envisaged that they should serve the needs of FAO to report upon the status of fisheries industries and of research on the marine resources. It is hoped that they will, in addition, be useful to fisheries oceanographers as sources of reference, and to fisheries biologists, economists, technologists and administrators as concise summaries of facts pertinent to their own problems. The pattern and method of preparation of Oceanographic Synopses is described in detail in FB/60/S5 (see inside back cover).

PREPARATION OF THIS DOCUMENT

1st Draft by S.J. Holt and T. Laevastu, November 1960

Distribution

FAO Fisheries Division
FAO Regional Fisheries Officers
Regional Fisheries Councils and Commissions
U.N. Agencies concerned with Oceanography
WMO Commission for Climatology
ICES Committees on Hydrography, Plankton and Near Northern Seas
Selected collaborators

"Current Bibliography" entry

FAO, Fisheries Division, 61-01198M
Biology Branch (1960)
FAO Fish.Biol.Synops.(5)
Preparation of regional fisheries oceanographic synopses.

Introduces the series of FAO Fisheries Biology Branch documents referred to as Oceanographic Synopses. Lists previous documents; proposes standard outline for a regional synopsis; summarises report by I. Hela to FAO, December 1959 on subject of title.

Project No.
2.21/3

CONTENTS

		Page
1.	INTRODUCTION	1
2.	OUTLINE FOR OCEANOGRAPHIC SYNOPSES	3
3.	EARLIER DOCUMENTS	5
4.	SUMMARY OF REPORT BY PROFESSOR I. HELA TO FAO, DECEMBER 1959	6
5.	SERIAL ATLAS OF THE MARINE ENVIRONMENT: NORTH ATLANTIC	10

1. INTRODUCTION

The Biology Branch of the Fisheries Division of FAO is concerned with scientific studies of the exploited and potential living resources of the oceans, and with the application of the information obtained for the better and fuller use of those resources. To this end the Branch compiles, interprets and disseminates pertinent facts; it is concerned with improving the methods of fisheries biological and fisheries oceanographic research, promoting the wider use of these methods, and encouraging the application of the results of research for the improvement of fisheries and the increase of fish yields.

Information about the resources which is compiled includes that pertaining to the oceanographic features of the environment of fish stocks and to their relations with that environment, as well as to oceanographic and climatological factors which affect, and may limit, fishing operations. From time to time synopses of information about particular geographical regions are prepared. These have usually been issued in connection with relevant international meetings, and in mimeograph form. Earlier documents, listed in section 3 of this paper, did not conform to a standard pattern. An attempt was made to develop, on the basis of experience gained, a pattern for such synopses, which could be applied to all areas - regardless of how intensely they had been investigated - and which would, in particular, help to identify gaps in knowledge. It was envisaged that such synopses would serve the primary needs of FAO to report regularly upon the status of fisheries industries and of research on the marine resources. It was hoped that they would, in addition, be useful to fisheries oceanographers as sources of reference, and to fisheries biologists, economists, technologists and administrators as concise summaries of facts pertinent to their own problems.

In November 1959, Professor Ilmo Hela of Finland, was consulted by FAO as to the methods of reduction of various kinds of oceanographic data for the purposes described above. He acquainted himself with the documentation systems so far developed in Fisheries Biology Branch (referred to as the Oceanic Thesaurus - OT), and proposed a new draft outline for the Oceanographic Synopses. A condensed form of Professor Hela's report is given as section 4 of this paper. Professor Hela further proposed that a "trial run" be made, using the North Sea as a test area. The

North Sea was chosen because of the abundance and apparent intractability of available data. A first draft of the North Sea Synopsis was submitted to the 48th Statutory Meeting of the International Council for the Exploration of the Sea (ICES) in Moscow, September 1960, where it was considered by the specialised committees concerned, especially the Hydrographic Committee. As a result the Council made the following recommendation:

"With reference to the report by FAO Fisheries Division on activities of mutual interest 1959/60, it is recommended that all member countries with experience in North Sea oceanography be enjoined to render, through ICES, all possible assistance to FAO in the realization of its project relating to the draft synopsis on the North Sea, on the understanding that there will be clear acknowledgement of the ICES collaboration and that ICES contribution shall relate to published material only".

As a result of the first trial with the North Sea Synopsis it appeared necessary to modify the standard outline slightly from that first proposed by Professor Hela and the form given in Section 2 of this paper was agreed with him.

After the first draft of the North Sea Synopsis had been presented to ICES, the possibility of the World Meteorological Organization (WMO) assisting in the revision of Section 3, CLIMATE, WEATHER AND HYDROLOGY, and the preparation of this section in subsequent synopses, was discussed. At its meeting in London in December, 1960, the Commission for Climatology of WMO considered the arrangements for this collaboration.

The Oceanographic Synopses will generally be issued within the "FB/../S" (Synopses) series of FAO Fisheries Biology documents and identified within this series by the symbol "OT". Pagination will begin anew with each section, to facilitate the issuance of revised parts of a synopsis; it is recommended that they be filed in ring binders. Corrections, criticism and general comments will be welcomed. It is intended that synopses for parts of the North Atlantic and neighbouring seas will, when judged to be sufficiently authoritative, be submitted for publication in the "Serial Atlas of the Marine Environment: North Atlantic", a project which is described in section 5 of this paper.

In connection with Professor Hela's suggestion for an eventual subject symposium on the oceanic ecology of the North Sea, it should be noted that it is proposed to take a preliminary step of convening in Rome,

probably at the end of 1961 or early in 1962, a small meeting of consultants. This meeting, which would last about five days, would have as its purposes:

a) To make proposals for coordinating the activities of the several bodies concerned with the biogeography of the North Atlantic

b) to discuss the content, arrangement, and support for the "Serial Atlas of the Marine Environment", and

c) to discuss plans and preparations for a scientific meeting on the biogeography of the marine environment at some future date.

2. OUTLINE FOR OCEANOGRAPHIC SYNOPSES

The following outline is based upon that proposed by Professor Ilmo Hela (see section 4).

1. INTRODUCTION
   - 1.1 Data and methods
     (Routes of expeditions; location of stations, profiles, sections, institutions engaged, data centres)
   - 1.2 Special aspects of data treatment

2. GEOGRAPHICAL AND GEOLOGICAL FEATURES
   - 2.1 General geographical characteristics
     - 2.1.1 Boundaries, areas and volumes
       (Also area, width and depth of the continental shelf)
     - 2.1.2 The coast
       (Geomorphology of the coast, length and nature of the shoreline)
     - 2.1.3 Shipping and fishing (general)
       (Fishing grounds, intensity of fishing, ports, distances, intensity of shipping)
   - 2.2 Submarine geology
     - 2.2.1 Bathymetry
     - 2.2.2 Nature of the bottom
       (Distribution of different types of sediments)

2.2.3 Properties of the sediments
(Grain size distribution, content of organic matter and carbonates, other chemical and physical properties)

2.2.4 Physical and chemical processes in the sediments
(Rate of sedimentation, deliberation of nutrients etc.)

3. CLIMATE, WEATHER AND HYDROLOGY

3.1 Climatological data
(Monthly and/or seasonal climatological data; atmospheric pressure, winds, frequency of storms, fogs and mists, air temperature etc.)

3.2 Characteristic seasonal weather conditions
(Examples of seasonally characteristic synoptic weather charts with short explanations)

3.3 Meteorological services
(Forecast areas, availability and nature of forecasts for shipping and fishing)

3.4 Hydrology
(Precipitation, drainage areas, run-off, their seasonal variations)

4. PHYSICAL AND DYNAMICAL OCEANOGRAPHIC CHARACTERISTICS

4.1 Tides, tidal currents, storm surges

4.2 Currents

4.3 Sea and swell

4.4 Water masses and their characteristics

4.5 Mixing and turbulence; water exchange; annual cycle of stratification and stability

4.6 Water temperature

4.7 Heat budget

4.8 Turbidity

4.9 Ice conditions

5. CHEMICAL OCEANOGRAPHY

5.1 Salinity, major constituents

5.2 Oxygen and other dissolved gases

5.3 Trace elements

5.4 Nutrient salts

5.5 Pollution

6. FLORA

(Under each sub-heading: Composition of floral communities; density and distribution; seasonal variations and determinants of these variations)

6.1 Seaweeds
6.2 Marine bacteria
6.3 Phytoplankton
6.4 Basic organic production

7. FAUNA

(Under each sub-heading: Composition, abundance and distribution of communities; seasonal variations)

7.1 Zooplankton
7.2 Phytoplankton-zooplankton relationship
7.3 Benthos
7.4 Nekton

3. EARLIER DOCUMENTS

FAO/55/10/6831, A note on the Fisheries Resources of the ICES Area, by FAO Fisheries Biology Branch. Issued as ICES Distant Northern Seas Committee C.M. 1955, No. 36.

The Survey of Living Aquatic Resources, by H. Rosa, Jr. (Reprinted from: Proceedings of the Gulf and Caribbean Fisheries Institute Ninth Annual Session, November 1956, Pages 153-170)

FAO/56/8/6299, The Present State of Knowledge on Fisheries Resources in the Mediterranean, by FAO Fisheries Biology Branch. Issued as GFCM WP.25/1, 1956.

FB/57/T58 The Present Status of Knowledge of the Living Resources of the Marine Waters of the West Coast of Africa, by FAO Fisheries Biology Branch. 1957.

FB/60/T5 Fisheries Resources of the East Coast of Africa and the Central Indian Ocean, by H. Rosa Jr. and T. Laevastu, 1960.

FB/60/S2 Synopsis of Information on the Oceanography of the North Sea, by T. Laevastu, 1960.

4. SUMMARY OF REPORT BY PROFESSOR I. HELA TO FAO, DECEMBER 1959

The purpose of the visit in November 1959 was defined as:

1. To advise on reduction of oceanographic and marine biological data for the Oceanic Thesaurus (OT) and eventual reorganization of the Oceanographic Synopsis; the report to contain a general appraisal of the intelligence work of the Fisheries Biology Branch, suggestions for the arrangement of OT, different forms to be used, the methods to be devised for reduction of data for fisheries purposes.

2. To become familiar with the systems of data compilation and handling in the Branch and the needs of different data for the work of FAO and for the study of international fisheries problems in general.

3. To comment on the methodological manuals being prepared by the Branch.

I expect to profit from my study of the Biology Branch systems both in my Institute and as Chairman of the ICES Sub-Committee on handling of hydrographic data.

The Oceanic Thesaurus project, when seen as a plan for the representation of the oceanic ecology of various sea areas, deserves support, since it will both promote fisheries biology and make oceanographic knowledge of various seas available - even to oceanographers - in a digested form and thus promote oceanography itself.

Before my visit to Rome, and while in Rome, I studied the various manuals being prepared by the Branch. The need for such manuals for field work, laboratory work, and so on, in oceanography and marine biology is very great, especially as many representatives of these fields of science are occasionally obliged to perform work with which they are not fully acquainted. It is most desirable for FAO to have these manuals published and distributed as soon as possible.

The purpose of the Oceanic Thesaurus must be to express the total oceanic knowledge at a given time in a form which can be used by fisheries biologists without further digestion or evaluation. Provision of perfect library facilities or data centres does not solve this problem, nor can the

objective be reached by means of a normal textbook on oceanography. The output of the Oceanic Thesaurus must take the form of independently prepared, but analogous, synopses for each region. For practical reasons the work must be organized so that synopses are complementary for the various regions described and may be extended to other regions, regardless of the workers involved and of particular nature of the available data for each region. The main purpose must therefore be to describe oceanic ecology of any given sea area in a systematic and logical way. This project must be an essential element in the program of work of the Branch.

Next comes the problem of representation. There are available a few excellent and stimulating oceanographic essays on certain sea areas. The writing of any kind of oceanic summary is however an extensive and difficult task because:

> our total oceanic knowledge can never be complete;
> many vital problems are not well understood at present;
> several independent approaches are made by workers representing different fields of science: these people often do not know each other's work, nor fully understand each other's writings;
> many oceanographic theories have for a time been most useful but have proved later to be wrong.

In addition to these basic difficulties, the final character of an essay makes this form of representation un-appealing to most scientists and not suitable for the FAO operation. Further, the scientific essay is not practical for Fisheries Biology Branch because:

> the writing of an essay for a new region is a laborious and very time-consuming task;
> an essay is difficult to bring up-to-date;
> comparison of different sea regions is not easy on the basis of essays, which cannot be strictly conformable or analogous.

The form of representation must therefore be a different and more practical one. In spite of all gaps in knowledge, a detailed scheme for a regional summary is better than a more general way of representation, since in this case:

comparisons are easier to carry out;
complementary additions and changes can be made more easily;
lack of certain information becomes more evident, which may stimulate other workers.

It seems useful to introduce the term "Oceanic Ecology" since, when representing the oceanography of a certain region, besides the geomorphological, dynamical, statistical features etc., special emphasis must be given to the fact that the Oceanic Thesaurus is devised in the interest of fisheries and of fisheries research. If a series of regional summaries on oceanic ecology can be prepared by FAO or under its auspices they will undoubtedly be among the most frequently cited papers in the field of marine science.

The regional summaries of oceanic ecology can be achieved as the result of the evaluation of existing knowledge and of new research. The task of FAO cannot be the conduct of this new research (except to some extent through the U.N. Technical Assistance activities and by arranging the concerted action of member countries through the FAO Fisheries Councils) but rather the collection, compilation, digestion and evaluation of knowledge that already exists.

For collection of original data (e.g., on salinity and temperature), a close collaboration must be established with the World Data Centres. The limited staff of the Biology Branch cannot however start to convert the original data into regional summaries. The approach must therefore be based on scientific papers, atlases, textbooks, data collections, etc., and unpublished but evaluated information known to marine scientists and fishermen.

In addition to its own work FAO should encourage and support steps towards the necessary evaluation of existing knowledge by other bodies in the various regions of the world.

Obviously the FAO staff cannot prepare many of these regional summaries at the same time. Instead the Biology Branch should start by continuing to collect papers and other material on a world-wide scale as indicated in the prepared Outline for the Oceanic Thesaurus, and, at the same time, prepare one regional summary on oceanic ecology for a selected area. It is suggested that the North Sea be selected for this purpose. The work should be done in the following order:

a) The first draft should be prepared by the staff of the Biology Branch.

b) The project for the Oceanic Thesaurus, with special reference to the North Sea, should be presented to ICES and thus the local institutes and agencies drawn into close cooperation. Comments on the first draft should be invited from them.

c) A second draft should be prepared.

d) A subject symposium on the oceanic ecology of the North Sea should be arranged with a few invited papers. The second draft and the invited papers should be distributed in advance of the meeting and ample time should be reserved for discussion.

e) Finally, the revised third edition should be made by the Branch. This should be distributed in loose leaf form.

It is evident that a large part of the first draft will have to be rewritten; later amendments and additions will alter even vital parts of the text and this will go on for several years. This fact must be taken into account in the practical handling of the task, especially in considering the form of duplication and the distribution of the various drafts. Later on, FAO should undertake the same task in relation to other sea areas. Eventually the role of the Fisheries Biology Branch might be limited to organizing and coordinating regional and institutional activities.

Finally, a few remarks are given with reference to the synopsis outline:

1) FAO should approach the various bathymetric offices in order to have general bathymetric charts prepared, at least for all the enclosed seas and regions of the continental shelf.

2) The present progress of submarine geology makes it most probable that in the near future other data on the chemistry (chlorophyll content, pH in situ, redoxpotential in situ) of bottom sediments, including the littoral facies, can be included. The same applies to coagulation processes at the interface between freshwater and saltwater, the coagulation being significant for the

fertility of the littoral facies. Later on, the role of radioactive substances must be taken into account.

3) Both the statistical-physical and the dynamical-synoptic approaches must be made to the various items under "Physical and dynamical oceanography". A special sea area cannot any more be characterized only by statistical (climatological) means but also whenever possible, by a few typical synoptic representations. (For example, an ice-chart of a certain day in a particular winter may be more useful than a chart giving the mean ice conditions of that particular calendar year).

4) In connection with the tides, the tidal flushing and, whenever possible, the residence time (half-life) of water masses in different basins must be referred to. A cross-reference must be made to the oxygen data whenever desirable. - In all the shallower areas, especially if the tidal range is limited, besides the actual astronomical tides, the seiches, internal seiches, progressive internal waves (that is, all the phenomena connected with storm surges) are most significant for the whole hydrography and productivity of the area. Since these phenomena occur aperiodically, they have been largely neglected. Special attention must be given to storms, which may effect conditions by activating stored nutrients and by oxygen enrichment in large sea areas, which in turn affects the migration of benthic animals and of demersal fish into those areas. In addition, the island-protected littoral shallows are flushed, with the result that their fertilizing effect is distributed, the coastal waters oxygenated and bottom material, with its nutrients and animals, transported.

5. SERIAL ATLAS OF THE MARINE ENVIRONMENT: NORTH ATLANTIC
(A Geographical Journal of Biological and Physical Oceanography)

The American Geographical Society, working with a panel set up by the Committee on Oceanography of the U.S. National Academy of Sciences - National Research Council, proposes to publish a scientific journal of an unusual kind, with the above tentative title. It will consist of maps, accompanied by any necessary explanatory text and will appear irregularly as contributions are received and accepted. It will be a medium for publication of studies of all kinds - biological, geological, physical, chemical - that will increase understanding of the marine environment.

Initially, it will be limited in scope to the Atlantic from the Equator to the North Pole, including the Arctic basin and the Mediterranean, and will be based on a specially prepared oblique sterographic azimuthal projection, an equal area projection especially suitable for plotting currents etc. (see below).

The proposed layout of charts was discussed by ICNAF at its 1958 Annual Meeting in Montreal, and has been published in "Science".

Scientists who contribute to the journal will be able to obtain the work sheets at nominal cost from the American Geographical Society. Any contributions to the subject will be welcomed, provided of course they conform with the editorial policy to be established by the Committee, and will be subject to editing by professional cartographers.

The atlas will be published in sheets 60x38 cm and will probably be available in two editions - one opaque and the other transparent, perhaps on film to facilitate comparative studies - and may also be issued on microcards.

It is believed that the new journal will meet a growing need in the study of the environment and of marine organisms and will offer a ready and standard means of recording and comparing distributions. Compiling and plotting the distributions of as many variables as possible will permit a broad approach to problems of spatial and temporal correlations and may uncover critical areas towards which new research efforts may be directed. The journal will also offer marine biologists a means of publishing material gathered incidentally in the course of their investigations that might otherwise stand little chance of being recorded.

The plan is sponsored in the United States by the National Academy of Sciences - National Research Council, and in Canada by the Royal Society of Canada. Funds are being sought in both countries. The panel is international, and consists at present of M.J. Dunbar (chairman), Lionel A. Walford (secretary), Charles B. Hitchcock, C. O'D Iselin, Ernest Thompson, C. S. Pittendrigh, T.W.M. Cameron and H. H. Hess. FAO is also represented on the panel and ICES has been invited to nominate a corresponding member.

FAO is collaborating with the sponsors of the Serial Atlas by submitting for publication in it regional synopses of oceanographic data and is adopting for its own use (as well as encouraging use by other organizations) the new base maps.

The Projection for the American Geographical Society's Base Maps

All map sheets for the North Atlantic are based on a projection centred at 54 degrees N., and 38 degrees W. This has been computed to enable lines of latitude and longitude at one-degree intervals, with the addition of half-degree intersections, to be plotted. The computations are sufficiently precise that graticules (grids of lines of latitude and longitude) for small areas within the general region can be plotted accurately on large scales. The projection also provides close to the optimum conformal presentation when the whole region is to be shown at a small scale on one sheet. (Strict conformality has been maintained by first transforming from the International Spheroid of Reference to a suitable conformal sphere and thence to the plane).

The work sheets have a scale of 1:300,000; the outline maps are on the nominal scale of 1:2,500,000 and feature coastlines and major rivers. The maps are printed in nonphotographic blue. The paper size for each sheet is 90x125 cm and ample space is left for marginal notes.

It is expected that base maps will eventually be required on a variety of scales covering many subregions. Though an attempt is being made to break up the whole region into suitable subregions, which can then be shown on individual base maps, it seems probable that many studies will not fall within the boundaries of any one base-map sheet. Thus a prime advantage of constructing all base maps on the same projection is that adjoining sheets on the same nominal scale can be fitted together exactly, without scale or angular discontinuities.

As the program develops, summarizing maps will be produced on certain topics that will illustrate the coordinated findings of several individuals working in various subregions. Also, maps will eventually be designed and constructed to show the relationships between two or more different types of phenomena. A single map projection used throughout will simplify the task of summarizing and coordination and will save time and expense in preparing maps for reproduction and publication.

On equal-area projections areas can be measured fairly precisely. On maps of the marine environment however, great precision in measuring areas will not often be warranted because the boundaries within which particular sets of physical or biological conditions exist can rarely be defined or mapped precisely. Furthermore, rather simple methods for rough

determination of areas that are available are applicable no matter what kind of map projection is used. Thus the equal-area property of a map is useful principally because it permits a visual appreciation of the relative sizes of areas, which is most often desirable on small-scale maps. Conformal map projections have the common property that angles are correctly represented, from which it follows that scale is constant in all directions about any point. Flow lines indicating, for instance, the directions of sea currents or the routes of migrations can thus be presented more accurately and more realistically on conformal projections than on any other type. Large-scale maps are most frequently on conformal projections, especially marine charts of coastal waters, because the conformal property is important in navigation. Linear scale on a conformal map projection will vary from point to point as on an equal-area projection, but it is important to note that it is not possible to combine the properties of conformality and equal area on one map. This can be approximated only when the region to be mapped is a very small part of the earth's surface.

On intermediate scales such as will be used in the Serial Atlas there is a legitimate choice between a conformal, an equal-area, and some compromise projection. The factors that made the American Geographical Society decide to use a conformal projection were (1) that the conformal property was considered more important than the equal-area property for series of maps which would presumably show the dynamics of distributions; (2) that the practical cartographical task of reducing raw data originally plotted on a variety of different map projections on large scales is most economically and accurately handled by using a conformal projection as the final base, because shapes of small areas are maintained better on this type of projection than on any other; (3) that the scale variation from point to point on a conformal projection can be made reasonably small for even rather large regions provided a proper choice of conformal projection has been made.

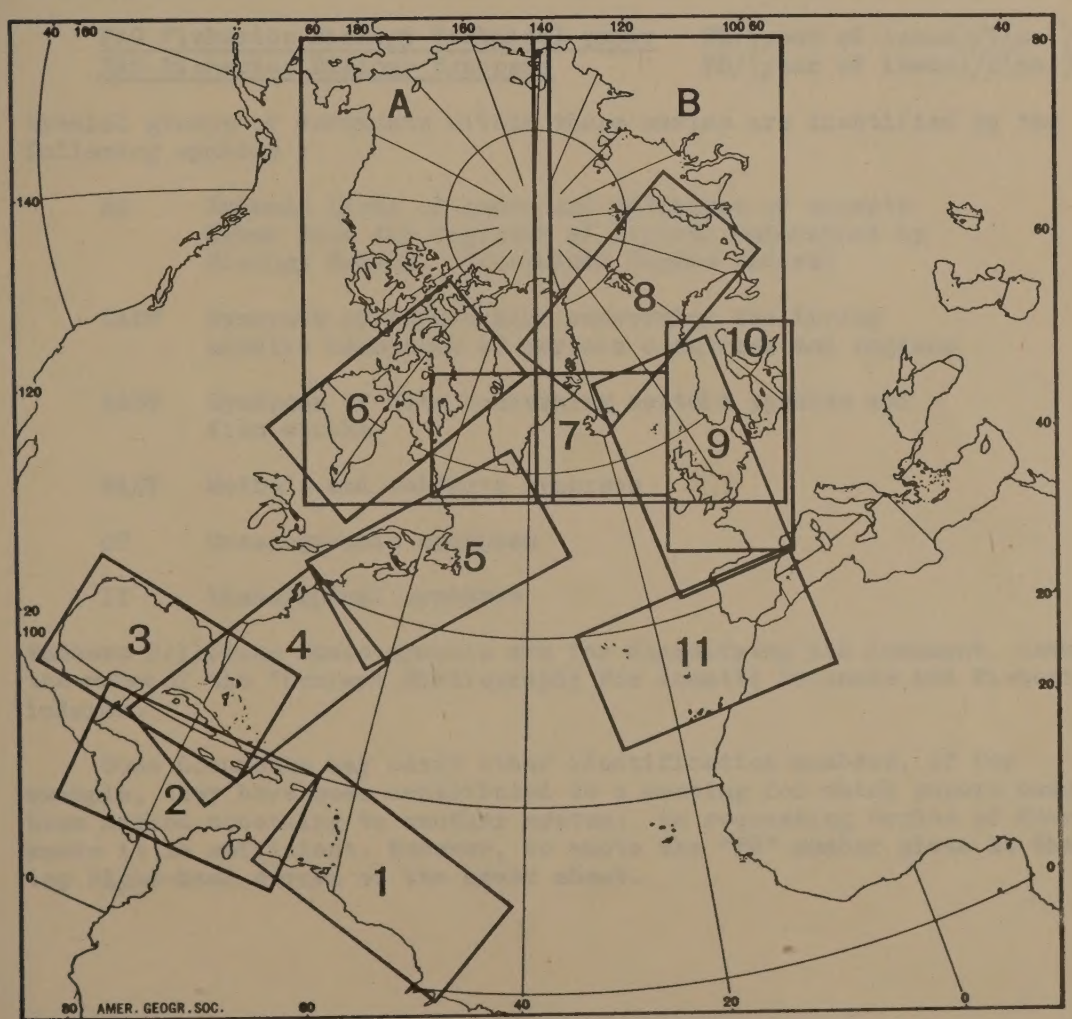
For any roughly circular region the best conformal map projection is an oblique stereographic such that a small circle centered on the origin of the projection more or less encloses the region. Lines of constant scale on such a projection are concentric circles about the origin, and the scale increases radially outward in proportion to $\sec^2 \frac{1}{2} \alpha$ where α is the arc radius of the concentric small circle.

The North Atlantic and adjacent seas can be contained by a small circle centred at 54 degrees N. and 38 degrees W. and having an arc radius

of about 50 degrees with minor protuberances on the western ends of the Caribbean Sea and the Gulf of Mexico, the eastern end of the Mediterranean, and the Siberian coast of the Arctic Basin. When the scale of the concentric small circle of arc radius 28 degrees is considered to be the nominal scale of the map, the scale deviations will never exceed 5 per cent within a concentric small circle of arc radius 38 degrees and will never exceed 15 per cent within a concentric small circle of arc radius 50 degrees.

In order that these maps may have proper and adequate distribution, no charge is being made by the American Geographical Society for compilation, printing, and handling costs. Those ordering the sheets are, however requested to pay for postage and cost of container used for shipping. Under this arrangement a maximum of ten copies of each sheet will be supplied to institutions or individuals. If more than ten copies of the same sheet are required, the Society will make a small charge for each additional copy of this sheet.

Sheets Available at Present



FAO Fisheries Division Biology Branch Documents

Two series of documents other than those prepared solely for FAO internal use are issued from the Biology Branch. These documents are not official FAO publications; they are given a restricted external distribution and this fact should be indicated if they are cited. Most of the documents in these series are prepared as working papers for meetings, or are summaries of information for the use of member governments, organizations, institutes and specialists concerned. The Series are :

FAO Fisheries Biology Technical paper	FB/(year of issue)/T(no.)
FAO Fisheries Biology Synopsis	FB/(year of issue)/S(no.)

Special groups of documents within these series are identified by the following symbols :

RE — Indexed lists of names and addresses of experts drawn from the Register of Experts maintained by Biology Branch. (Technical Papers series)

CART — Synopses of information concerning the living aquatic resources of certain countries and regions

SAST — Synopses of data concerning certain species and fish stocks

MAST — Methods and subjects synopses

OT — Oceanographic synopses

IT — Limnological synopses

Numbers following these symbols are for classifying the document, using the codes of the "Current Bibliography for Aquatic Sciences and Fisheries" indexes.

Some documents may carry other identification numbers, if for example, they have been contributed to a meeting for which papers have been marked according to another system; in requesting copies of documents it is sufficient, however, to quote the "FB" number given at the top right-hand corner of the cover sheet.